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Volume 4

Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR)

User's Guide

Part 1: Overview of NUCLARR Data Retrieval

COMPLETED

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Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities.

The NUCLARR system is documented in a five-volume series of reports. Volume IV of this series is the User's Guide for operating the NUCLARR software and is presented in three parts. This report, Part 1: Overview of NUCLARR Data Retrieval, provides an introductory overview to the system's capabilities and procedures for data retrieval. The methods and criteria for selection of data sources and entering them into the NUCLARR system are also described in this document. Part 2: Guide to Operations contains the instructions and basic procedures for using the NUCLARR software. Part 2 provides guidance and information for getting started, performing the desired functions, and making the most efficient use of the system's features. Part 3: NUCLARR System Description provides an in-depth discussion of the design characteristics and special features of the NUCLARR software. Part 3 presents the organization of the data base structures and techniques used to manipulate the data.

It is recommended that the new user first become acquainted with Part 1 in order to get an overview of the NUCLARR system. Then, familiarity with Part 2 for operating the software is recommended. Access to Part 3 should be obtained if the user is interested in learning more about the internal aspects of the NUCLARR software functions and capabilities.

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SUMMARY

The Nuclear Computerized Library for assessing Reactor Reliability (NUCLARR) is documented in a series of five volumes. Volume I: Summary Description is a general overview of the NUCLARR system. Volume I provides the background of the NUCLARR program, including a description of methods for data collection, system specification, data structures, and taxonomies. Volume II: Programmer's Guide provides information for maintaining the software for the NUCLARR system. Volume III: Data Base Management Guide for Processing Data and Revising the Data Manual contains the procedures for processing human error probability and hardware component failure data and entering the data values into the NUCLARR system. Volume IV: User's Guide instructs the end user in operating the NUCLARR software. Volume V: Data Manual is a hard-copy report of the data residing in the NUCLARR system.

Volume IV is presented in three parts for the convenience of the user. This report, Part 1: Overview of NUCLARR Data Retrieval, describes the scope of the NUCLARR system, support organizations, methodologies for screening data sources for entry, and guidance for using Parts 2 and 3. Part 2: Guide to Operations tells the end user how to get started and walks through the mechanics for performing data base operations (e.g., file management, data aggregations, search and retrieval of data). Part 3: NUCLARR System Description describes in detail the organization and special features of the NUCLARR software, including an explanation of the methods for data aggregations and calculations.

Information for obtaining the NUCLARR software and/or documentation should be directed to:

Thomas G. Ryan
U.S. Nuclear Regulatory Commission - RES
Reliability and Human Factors Branch
5640 Nicholson Lane, NL/N-316
Rockville, MD 20852 USA
(Phone) 301-492-3550

or

David I. Gertman
NUCLARR Data Clearinghouse
Idaho National Engineering Laboratory
P. O. Box 1625
Idaho Falls, ID 83415 USA
(Phone) 208-526-0652

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ACRONYMS

AI	artificial intelligence
HEP	human error probability
HCFD	hardware component failure data
HHRAG	Human and Hardware Reliability Analysis Group
HRA	human reliability assessment
INEL	Idaho National Engineering Laboratory
IRRAS	Integrated Reliability and Risk Analysis System
NRC	U.S Nuclear Regulatory Commission
NUCLARR	Nuclear Computerized Library for Assessing Reactor Reliability
PC	personal computer
PRA	probabilistic risk assessment
PSF	performance shaping factors
RC	recovery considered
RNC	recovery not considered
SARA	Systems Analysis and Risk Assessment System

NUCLEAR COMPUTERIZED LIBRARY FOR ASSESSING REACTOR RELIABILITY (NUCLARR)
VOLUME IV: USER'S GUIDE
PART 1: OVERVIEW OF NUCLARR DATA RETRIEVAL

1. INTRODUCTION

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system used to process, store, and retrieve human and hardware reliability data in a ready-to-use format. The NUCLARR system was developed by the U.S. Nuclear Regulatory Commission (NRC) to provide the risk analysis community a repository of data that can be used to support a variety of risk assessment activities. The system maintains a broad range of data base management functions for storing, processing, and retrieving human error and component failure rate data. Computational algorithms for aggregating the source data and routines for report generation are also provided. The system software, designed for operation on an IBM[a] personal computer (PC) (or PC compatible) microcomputer, is readily transportable to a wide range of users.

The equipment taxonomies and data structures for NUCLARR were designed specifically to support probabilistic risk assessment (PRA) techniques currently used by the nuclear power industry. The NUCLARR system aids the risk analysis process by providing the analyst with accurate and relevant data from an on-line data base. This computerized capability gives the analyst a powerful device to search and retrieve data in a timely fashion. The former drudgery of reviewing multiple hard-copy documents to obtain useful data has now been eliminated with the availability of NUCLARR.

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However, the capabilities of NUCLARR as a compact, transportable, and functional PRA workstation should also be contrasted with what it is not. For example, NUCLARR is not an artificial intelligence (AI)/expert system. It is assumed that the analyst must bring some prior skills and knowledge to bear in order to make effective utilization of this tool. In this regard, NUCLARR can best be classified as a library and not a chief librarian. The concept of furnishing analysts with a highly mechanistic or "cook book" approach for data usage was ruled out in exchange for a system that would be both flexible and comprehensive for adapting to a wide diversity of applications. It was also determined, at the onset, that NUCLARR would not provide the capability to construct fault trees or core melt frequencies. Other tools already exist that provide these functions, and it was felt that NUCLARR could better support the risk analyst by supplying the data inputs to these other products. The Integrated Reliability and Risk Analysis System (IRRAS) and Systems Analysis and Risk Assessment System (SARA) are two such products, developed under NRC sponsorship, that provide the capabilities for higher-order model development and analysis.[1,2] Future development efforts at the Idaho National Engineering Laboratory (INEL) will focus on devising more effective ways to interface NUCLARR, as a supplier of source data, to support these other programs.

In summary, the present version of NUCLARR, as described in this manual, provides the experienced user (e.g., PRA analyst) with an important computer-based support capability for conducting risk analysis. Very little, if any, training is required before the analyst is able to access human error probability (HEP) and hardware component failure data (HCFD).

The purpose of this three-part document is to provide the end user with a detailed description of the NUCLARR data management system, including instructions for accessing and retrieving specific data. To that end, an overview of the NUCLARR system is given in Part 1. Parts 2 and 3 of this document provide, respectively, a guide to operations (including examples) and a detailed system description that defines all attributes of the data being stored, describes the way in which these data are stored, and describes computations performed by the NUCLARR system.

2. NUCLARR SYSTEM SUPPORT

Support services for software maintenance, user documentation, and data base management functions for handling data entry reside at the INEL. Personnel responsible for these various NUCLARR support services have been assigned to one or more functional organizations. All data input and software management functions for NUCLARR are performed by NUCLARR Data Clearinghouse personnel. A detailed list of proceduralized steps are followed in processing the data sources from initial screening to data entry. The NUCLARR Data Clearinghouse is also the primary interface and point of contact for data suppliers and end users of the NUCLARR system. This group is responsible for all interactions among NUCLARR system users. Data Clearinghouse personnel have been charged with the responsibility for distributing NUCLARR software and user documentation to requesters and for acting as a resource to answer questions, provide supplemental advice and material regarding the uses of certain source data, and to consult with users on an as-needed basis.

Data Clearinghouse personnel are assisted by the Human and Hardware Reliability Analysis Group (HHRAG), which reviews data sources for suitability. The personnel who make up the HHRAG group are experienced in one or more of the following disciplines: nuclear power plant operations, human reliability analysis (HRA), PRA analysis, system reliability, and generic safety issues. This core group of individuals is supported by data entry technicians and software engineers. The HHRAG is also responsible for improving data processing procedures and data base taxonomies to assist in a more efficient treatment of data.

A Review Committee has been selected to provide technical direction to the HHRAG. Membership on the Review Committee is established on approval of the NUCLARR program technical monitor, and members serve on a rotating basis. The Review Committee, consisting of members both within and external to the NUCLARR project team, meets on a periodic basis to review recommendations for changes and upgrades to the NUCLARR system. Additional duties involve quality assessment of the data stored in NUCLARR prior to its distribution to the end users.

Any questions regarding data collection, data submission, requests for software diskettes, and/or use of the NUCLARR system should be made directly to the address and phone numbers shown below:

David I. Gertman
NUCLARR Data Clearinghouse
Idaho National Engineering Laboratory
P. O. Box 1625, MS 2405
Idaho Falls, ID 83415
(Phone) 208-526-0652

Additional questions may also be directed to the NRC Technical Monitor for this program at the following location:

Thomas G. Ryan
U.S. Nuclear Regulatory Commission - RES
Reliability and Human Factors Branch
5640 Nicholson Lane, NL/N-316
Rockville, MD 20852 USA
(Phone) 301-492-3550

The user is encouraged to seek help from the NUCLARR Data Clearinghouse whenever problems should arise. In order to obtain some feedback for future revisions of NUCLARR, your time and consideration in filling out the questionnaire (Appendix A of Part 1) and returning it to the NUCLARR Data Clearinghouse would be greatly appreciated.

Users are also encouraged to submit any sources of human error and/or hardware failure data that could potentially be entered into the NUCLARR system. A mission of the NUCLARR project is to pursue all possible sources and recommendations for data, and any assistance from the end users toward meeting this objective will be greatly appreciated. Any information regarding sources of data for NUCLARR can be directed to David Gertman at the INEL (address and phone number shown above).

3. SELECTION AND SCREENING PROCEDURES FOR PROCESSING NUCLARR SOURCE DATA

The NUCLARR system is a live repository of source data, and the process of data entry is an ongoing task. Periodically, depending upon the rate at which data are collected and entered, revisions to the documentation and data files will be published that incorporate the new data as well as any changes to the system taxonomy. A list of users will be maintained to ensure that everyone has the most recent version of NUCLARR. Any individual or organization may submit data to the Data Clearinghouse for consideration for entry into the NUCLARR system; such submittals are welcomed. All HEP and HCFD received will be screened for suitability by the HHRAG.

Basic criteria for data inclusion in NUCLARR are described below. Additional specifications and guidelines for determining the type of source data that would be acceptable for entry into the NUCLARR system are contained in References 3, 4, and 5. These reports are readily available upon request from the NUCLARR Data Clearinghouse.

3.1 Scope of Human Error Probability Data

HEP data provide quantitative probability estimates for use in assessing the impact of undesirable human actions on nuclear power plant operation and safety. Two forms of errors are possible: commissions and omissions. The commission probabilities stored in NUCLARR are all errors; i.e., either actions performed incorrectly or inappropriate actions performed. As such, these errors are classified by first specifying a verb describing the action. To fully categorize the error, the nuclear power plant equipment that was most directly affected by the action must also be specified.

For errors of omission, two types of data are possible. The first type is probabilities for oversights and errors in which tasks are not performed. The second type is probabilities for failure to accomplish a task within a specified time period. Such timing information is stored

along with the error data in the NUCLARR system because it concerns omissions, e.g. failure to perform, and is useful for assessing reactor reliability.

As with commission data, all omission HEPs are classified according to both the human action verb that describes what was supposed to have been done and the plant equipment that was affected. For the HEP data, three possible levels of equipment may be referenced--systems, components, and the parts of components that directly interact with the operators (i.e., displays, instrumentation, and controls).

In addition to the classification of HEP data by omission and commission, further data characterization is accomplished by determining whether "recovery considered" (RC) or "recovery not considered" (RNC) applies in the derivation of the HEP values.

In summary, HEP data that are accepted for inclusion into the NUCLARR system must meet the following general criteria:

- The data must involve a human action that was performed or was supposed to be performed.
- The data must describe the equipment that was the object of the human action.
- The data must provide quantitative values of error probability in the form of an HEP point value, probability distribution, or a ratio of errors to estimated opportunities for error.

3.2 Scope of Hardware Component Failure Rate Data

The HCFD requirements for NUCLARR apply to component failure rates and probabilities. Maintenance unavailability data and failure data for analysis of root causes or common causes are not included at this time. Furthermore, the emphasis is specifically on component failures, not

general losses of function. For example, data for equipment that is in an improper state (command faulted) and therefore unavailable due to a human error is contained in the HEP portions of the NUCLARR system. The failure events of interest for the component failure part of NUCLARR are those events in which the components required some type of repair, replacement, or adjustment.

The components selected for inclusion in the NUCLARR system are those that are typically involved in basic events in fault tree models of nuclear power plant systems. Thus, they are, for the most part, the types of components found in safety systems.

To the extent possible, component failure rates are based on failures occurring within specified component boundaries. A component boundary should include the physical boundary of the component itself plus any associated, dedicated auxiliary equipment. This includes closely associated equipment that is physically coupled, such as generators or pumps with their drivers (diesel engines, motors, etc.) and valves or dampers with their operators (motor, pneumatic, etc.). Also, this includes dedicated control circuits and circuit breakers associated with pump motors, valve operators, and diesel generators. For diesel generators, it additionally includes dedicated air starting systems and dedicated batteries. Similarly, lube oil cooling failures are included in the data set for those components that provide their own lube oil cooling function.

Secondary failures are excluded if possible when computing NUCLARR component failure rates; i.e., failures that result from events outside the boundary of the component and produce conditions exceeding the component's design basis should be excluded. Failures that are caused by common support systems or improper inputs are not included in the failure rates, if possible, because these are modeled separately in most risk assessments. For example, consider a front line system pump failure caused by a loss of the pump's lube oil cooling which, in turn, is due to a failure in the component cooling water system. Ideally, no front line system pump failure would be counted, even though the front line system

pump experienced a failure that required repair. Such failures should not be included in the failure data because their occurrence is entirely dependent on the specific designs of the systems involved. They are not needed in the failure data sets because PRA system models will identify what components will fail due to the loss of each support system. Thus, the ideal failure rate data are dependent only on the component and its immediate environment and application and are independent of the specific plant and system designs. Sources that include secondary failures in the basic failure rate data tend to have higher failure rate estimates; however, data from these sources are included in the data base because, in most cases, the impact of these failures is minimized by the protective devices commonly installed on components.

In summary, in order to be included in the NUCLARR data base the component failure data must have:

- A description of component and failure mode, and
- Probability values (i.e., number of failures and number of operating hours or demands, or the rate itself).

3.3 Screening of NUCLARR Data

In keeping with the philosophy of the NUCLARR system as a repository, or library of source data, NUCLARR is not designed to contain an "approved" set of restricted data to meet the needs of risk analysis. Instead, any data point that complies with the minimal qualifications for entry and passes a quality standard established by the HHRAG is a likely candidate for acceptance in NUCLARR. Determining the suitability for a selected data point in a given application ultimately rests with the end user of the system. However, this does not lessen the responsibility of the NUCLARR support HHRAG organizations, since previewing data is a requirement before entry. Rather, the NUCLARR system should be viewed by the user as a resource where screened information can be sought, but interpretation and caution regarding data usage for a given application should be observed.

In cases where the user is not sure about the applicability of certain data, it is a key function of Data Clearinghouse personnel to respond to questions and provide guidance on making the best use of available data.

4. NUCLARR DATA TREATMENT

This section provides a brief summary of the calculations performed by the NUCLARR system on the source data. If possible, a lognormal distribution is fitted to each input HEP or HCFD failure rate or probability of failure on demand. This allows NUCLARR to display means and medians as well as upper bounds. For the HEP data, the number of errors and opportunities for error is the preferred form of data; the system will attempt to compute such counts from point estimates of HEPs and upper confidence limits if they are not provided. For the HCFD, because raw data are important, a point estimate based on the number of failures and operating hours or demands is displayed as the mean, rather than displaying the mean of the fitted lognormal distribution (if such raw data are supplied by a data source).

In addition to providing a format for viewing and comparing individual data points from a variety of sources, NUCLARR provides data combinations. HEP data and HCFD can each be located by ad hoc searches; aggregated values and bounds describing the combined data set are provided by NUCLARR. There are also predefined, automatic aggregations.

For HEP data, individual error probabilities are combined first to describe tasks. Task probabilities not only have a common action verb and equipment designation, but they also have similar performance shaping factors (PSFs) and are expected to describe similar conditions. Homogeneity is expected of the data representing a single task; thus, pooling of numbers of errors and numbers of opportunities for error is used as the statistical method for generating task statement aggregations. Data that are found not to be homogeneous are omitted from these calculations. These calculation methods are also applied to the ad hoc aggregations.

Two higher levels of aggregations are automatically supplied by the NUCLARR system for the HEP data. The first is a combining of all the task HEPs into a cell; i.e., all the task HEPs associated with a common human action verb and equipment designation. The second is the combining of task

HEPs for a functional group summary cell. This is a cell whose associated equipment is general and reflects a group of components (several types of pumps being affected, for example) or a group of systems or displays. For both of these sets of automatic aggregations, lognormal distributions fitted for each task HEP are combined to produce a lognormal distribution for the geometric average of the individual task HEPs.

In all of the HEP automatic aggregations, data for omission errors are never automatically combined with data for commission errors. Also, RC is tracked for each HEP data point, and RC data are never combined with RNC data. Thus, there is a possibility of four aggregated HEPs for each of the automatic aggregations.

For the HCFD, automatic aggregations are performed for events. Events are defined by the associated component category (mechanical or electrical), type (e.g battery), design (e.g. wet cell), normal state, and failure mode group. There are four failure mode groups: fail to operate, spurious operation, leakage, and blockage. Within each group there are more specific failure modes, such as fail to start or external leakage; these may also be considered in the event aggregations. Automatic aggregations are computed for all combinations of the following five event levels: (a) component/failure mode group; (b) component/failure mode; (c) component/design/failure mode group; (d) component/design/failure mode; and (e) component/design/failure mode/normal state. In each of these cases, failure rates over time (per hour) are never combined with probabilities of failure on demand.

A single method is used both for automatic (precomputed) and ad hoc HCFD aggregations. The method is based on the form of the data present. It selects a lognormal distribution that reflects the population variability shown by the data being combined. It focuses on raw data (numbers of failures and exposure to failure) where they are present and also considers whether the data might have been previously aggregated. The method is described in detail in Reference 6 and is also outlined in Part 3 of this document. It results in a point estimate and upper tolerance bound.

5. HOW TO USE THIS GUIDE

The first step in using this guide is to acquire the NUCLARR system software, which consists of one installation diskette and 14 diskettes of NUCLARR data. The NUCLARR system requires an IBM-PC or PC-compatible computer with 5.5 megabytes of disk space and a math co-processor. The NUCLARR Data Clearinghouse is the point of contact for joining the list of NUCLARR users.

This guide (Volume IV) is organized into three parts in order to provide all the procedures needed for operating the NUCLARR system software. In Part 2: Guide to Operations, specific guidance is provided for instructing the user on how to install the system and how to locate and retrieve data to perform a risk analysis. In addition, directions are available for determining the degree to which selected data can be applied to a specific application. If directly applicable data are not available, the guide contains instructions for locating alternative sources of data in the NUCLARR system. The operations guide concludes with examples and tutorials to demonstrate how the user accesses data and applies it to particular situations. As stated above, NUCLARR system managing software and data files are stored on PC diskettes and are available upon request by contacting the Data Clearinghouse.

The user documentation prepared for the NUCLARR system was developed for software Version 1.1. All procedures, specifications, and operating instructions described in the contents of the User's Guide were written for this version. In the near future, as more users gain familiarity with the NUCLARR system, enhancements to the original software are expected. As new versions become available, the NUCLARR Data Clearinghouse will notify the users of any new software releases. It is envisioned that any new releases will be accompanied by an informal document containing any modifications and additions that were implemented since the last version. New editions of the User's Guide will periodically be made to track with future changes to the software. A new revision to software Version 1.1 is expected to be ready for public release by the first quarter of 1989.

Part 3: System Description of this guide is intended to provide the user with reference material to clarify the organization and special features of the NUCLARR system. This part contains an in-depth discussion of the design characteristics of NUCLARR, including a complete description of the various information fields displayed on the data records for hardware and human error data. Details regarding the data taxonomies and system architecture are also presented. In addition, Part 3 also provides the user with a comprehensive explanation of the data aggregation techniques and calculations performed by the NUCLARR system.

Figure 1 provides an overview of how the various parts of this User's Guide can be used in performing a risk assessment.

This guide, intended for the end user, is the fourth in a series of five reports. A description of the other reports within this series is presented below:

- Volume I: Summary Description--presents a general introduction to the NUCLARR System. In this document, the background and history of the program are described. Information regarding the organization, structural taxonomy, and key features of the NUCLARR system are also summarized. This report is intended to be used by individuals who are interested in obtaining a top-level overview of the system's functions and capabilities.[7]

- Volume II: Programmer's Guide--provides information necessary for maintaining the software of the NUCLARR system. Descriptions of the data base structure, system taxonomy, programs, support libraries, main menus, computer environment, and structural rebuild instructions are provided. This report is intended for use by the software engineer maintaining and modifying the NUCLARR programs.[8]

- Volume III: Data Base Management Guide--provides the input procedures for extracting suitable data from candidate source

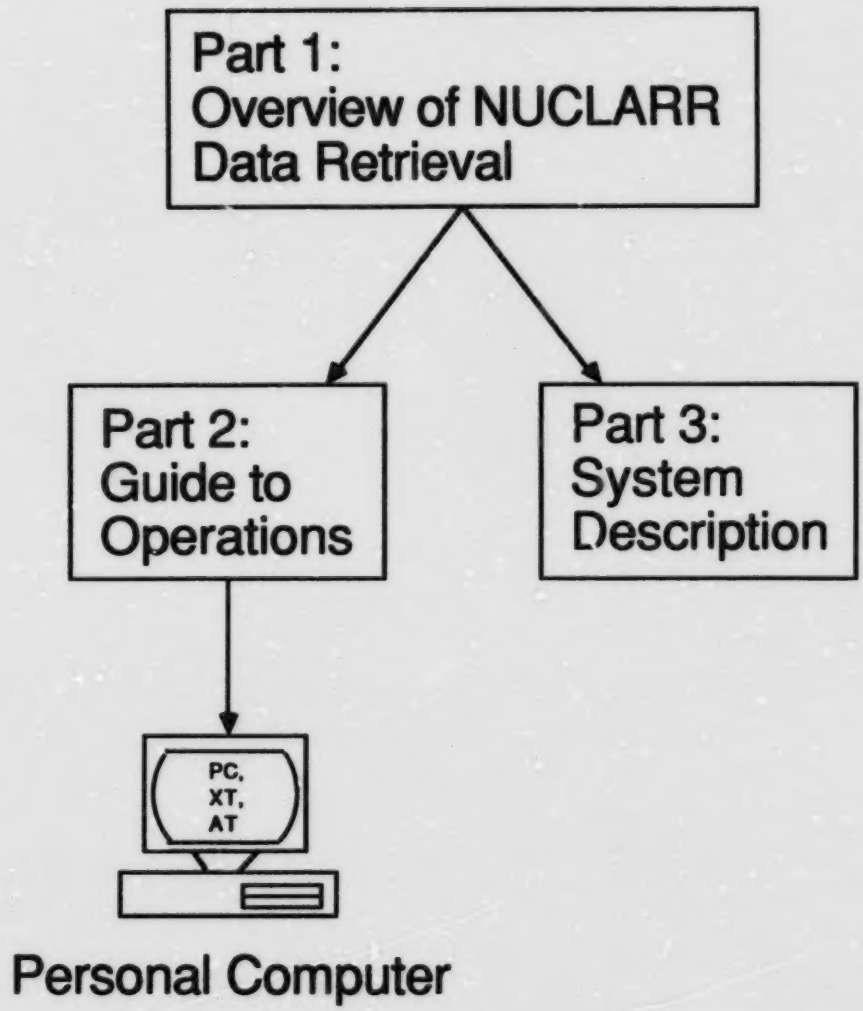

Figure 1. Task Flow for Volume IV: User's Guide

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documents and entering this information into the NUCLARR system. In addition, procedures are also provided for revising the data base taxonomy and structure. This guide is intended primarily for use by members of the HHRAG and NUCLARR Data Clearinghouse who are responsible for screening and entering the data. Its contents also serve as a resource for data entry clerks who may be tasked with loading data items and document information into the NUCLARR system.[9]

- Volume V: Data Manual--provides data requesters with a hard-copy version of all data and supporting information residing on the NUCLARR system computerized data base. The manual is a stand-alone document enabling the data requester and the Data Clearinghouse access to data without use of the on-line data base. This report is updated periodically to provide ready reference material to the data requester (e.g., PRA analyst).[10] There are four parts to Volume V: a Summary and Description; Appendix A--HEP Data; Appendix B--Hardware Component Failure Data; and Appendix C--NUCLARR Summary Aggregations.

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APPENDIX A

USER SATISFACTION QUESTIONNAIRE

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USER SATISFACTION QUESTIONNAIRE

It is our intent to treat the NUCLARR software and User's Guide as living products. Future revisions to the software and User's Guide will be implemented to enhance their overall useability and acceptance by the end users. To produce a document that improves on previous iterations, your feedback is needed.

The following questionnaire is divided into two sections. Section I contains questions regarding the content of Parts 1, 2, and 3 of the User's Guide. In Section II, we are interested in your opinions about the software. A space is also provided at the end of each section for any additional comments you may have that are not relevant to any of the stated questions. Be as straightforward and critical as you like. However, we do ask that your responses be specific, so that we can adequately focus on any problems you may have with the software or documents.

Please take a few minutes to fill out the attached evaluation form and return it to:

David I. Gertman
NUCLARR Data Clearinghouse
Idaho National Engineering Laboratory
P.O. Box 1625
Idaho Falls, ID 83415

Your time and consideration in completing this form and returning it to us is greatly appreciated.

The questionnaire begins on the next page.

USER SATISFACTION QUESTIONNAIRE

SECTION I--USER'S GUIDE

1. Are the contents of the User's Guide well organized? If your answer to this question is no, provide an explanation.

2. Does the User's Guide contain all the information you need for operating the NUCLARR Software? If your answer to this question is no, what specific type of information was lacking?

3. Of the three parts to the User's Guide, which part did you find the most useful (Part 1, 2, or 3)? Explain your answer.

SECTION 1 (CONTINUED)

4. Of the three parts to the User's Guide, which part did you find the least useful (Part 1, 2, or 3)? Explain your answer.

5. Additional comments--User's Guide:

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SECTION II--SOFTWARE

1. Please check the features that were most important to you when using the NUCLARR software (check all that apply).

_____ Human Error Probability (HEP) side

_____ Hardware Component Failure Data (HCFD) side

_____ Data Aggregation: User-Inititated

_____ Data Aggregation: Fixed, non-user-inititated

_____ Desciptive Search Mode (menu-driven feature)

_____ Ad-Hoc Search Mode (defining data sets from list of parameters)

_____ Document File

_____ File Management for transporting data sets to other programs

2. What additional features would you like to see in future versions of the NUCLARR software?

3. Would you recommend the NUCLARR software to an associate? Why or why not?

4. Additional comments--software:

END OF QUESTIONNAIRE

* * * * *

May we contact you for more information regarding the questionnaire?

If yes, enter your name and telephone number in the space provided so that we can get back to you. (Otherwise, leave this space blank.)

Name: _____ Telephone:_____

Thanks again for your help!!!

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SEE INSTRUCTIONS ON THE REVERSE

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User's Guide
Part 1: Overview of NUCLARR Data Retrieval

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Gretchen H. Beers
William J. Galyean
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The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities.

The NUCLARR system is documented in a five-volume series of reports. Volume IV: User's Guide is presented in three parts. Part 1: Overview of NUCLARR Data Retrieval, provides an introductory overview to the system's capabilities and procedures for data retrieval. Part 2: Guide to Operations contains the instructions and basic procedures for using the NUCLARR software. Part 3: NUCLARR System Description provides an in-depth discussion of the design characteristics and special features of the NUCLARR software.

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